

GUT813207B CREP WETLAND PROJECT
SECTION 7, TOWNSHIP 81N, RANGE 32W
GUTHRIE COUNTY, IOWA



I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS
PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION
AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF IOWA.


TROY J. GROTH, P.E. #14450

02/23/2017
DATE

MY LICENSE RENEWAL DATE IS DECEMBER 31, 2017.

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**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-1 SITE PREPARATION

1. SCOPE

Site preparation work shall consist of clearing, grubbing, stripping, refuse removal, bank sloping and structure removal on the site as necessary to rid the site of all undesirable materials on or near the surface and prepare the site for the structure. All woody growth within the construction area shall be cleared and all stumps and roots one inch in diameter or larger shall be grubbed from the site. In addition, all areas within 25 feet of the footprint of the structure shall be cleared and grubbed except as directed by the Engineer. The work shall also consist of the removal and disposal of structures (including fences) that must be removed to perform other items of work.

For wetland restoration, enhancement, or creation projects, the wetland area shall be disturbed as little as possible and existing naturally vegetated spillway areas shall not be disturbed.

2. FOUNDATION PREPARATION

The construction areas shall be stripped a minimum of 6 inches to remove all unsuitable materials such as organic matter, grasses, weeds, sod, debris, and stones larger than 6 inches in diameter.

In an earth embankment foundation area, all channel banks and sharp breaks shall be sloped to no steeper than 1.5 horizontal to 1 vertical.

The foundation area shall be thoroughly scarified before placement of fill material. The surface shall have moisture added or shall be compacted if necessary so that the first layer of fill material can be compacted and bonded to the foundation.

3. STRIPPED MATERIAL DISPOSAL

Suitable soil material shall be stockpiled for use as topsoil. The other stripped materials shall be buried, removed from the site, or disposed of as directed by the Engineer. Whenever possible, material shall not be disposed of in the pool area created by the structure.

Stockpiled materials around a construction site should be placed so as not to hinder subsequent construction operations.

4. DISPOSAL OF REFUSE MATERIALS

Waste materials from clearing and structure removal shall be burned or buried at locations approved by the owner. Buried materials shall be covered with a minimum of 2 feet of earthfill. Whenever possible, material shall not be disposed of in any pool area created by the structure.

All refuse shall be disposed of in a manner which complies with all local and state regulations.

5. SALVAGE

Items to be salvaged shall be as shown on the drawings. Structures and fencing materials that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas.

6. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 1, Site Preparation

- (1) This item shall consist of the work necessary to begin construction including, but not limited to, clearing & grubbing all trees within the easement area below elevation 1126.0, mowing existing vegetation and stripping the areas to be excavated or foundation areas for fill.
- (2) Contractor will be required to replace fence removed to perform other items of work.
- (3) Payment for this item will be made at the contract lump sum price and will constitute full compensation for completion of the work.
- (4) Payment will constitute full compensation for the following related subsidiary item: Pollution Control.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-5 POLLUTION CONTROL

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations.

2. MATERIALS

All materials furnished shall meet the requirements shown on the drawings or in the specifications.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The measures and works shall include, but are not limited to, the following:

Staging of Earthwork Activities: The excavation and moving of soil materials shall be scheduled so that areas unprotected from erosion will be minimized. These areas will be unprotected for the shortest time feasible.

Seeding: Structures and disturbed areas shall be seeded as soon as possible after construction is completed.

Temporary seedings may be used as an alternative to other stabilization measures as approved by the Engineer.

Mulching: Construction areas that have been disturbed but have no construction activity scheduled for 21 days or more shall have erosion protection measures applied by the 14th day. This erosion protection may be mulching or other approved temporary measures. Construction areas shall not be left open during a winter shutdown period and shall be protected by mulching.

All seeding and mulching shall be completed in accordance with the seeding plan and Iowa Construction Specification IA-6, Seeding and Mulching for Protective Cover.

The following works may be temporary. If they are installed as a temporary measure, they shall be removed and the area restored to its original state when they are no longer needed or when permanent measures are installed.

Diversions: Diversions may be required to divert clean runoff water away from work areas and to collect runoff from work areas for treatment and safe disposition.

Stream Crossings: Culverts or bridges may be required where construction equipment must cross streams.

Sediment Basins: Sediment basins may be required to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Sediment Filters: Straw bale filters, geotextile sediment fences, or other equivalent methods may be used to trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under them.

Waterways: Waterways may be required for the safe removal of runoff from fields, diversions, and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide watertight tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants, such as drained lubricating or transmission oils, greases, soaps, concrete mixer wash water, asphalt, etc., produced as a by-product of the construction work. At the completion of the construction work, sumps shall be removed and the area restored without causing pollution.

Sanitary facilities such as chemical toilets or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources. At the completion of construction work, facilities shall be disposed of without causing pollution.

5. AIR POLLUTION

The burning of brush or trash or disposal of other materials shall adhere to local and state regulations.

Fire prevention measures shall be taken to prevent the start or the spreading of wild fires, which result from project work. Fire breaks or guards shall be constructed at locations shown on the drawings.

All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall insure safe operations at all times. If chemical dust suppressants are used, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the Engineer five working days before use.

6. MAINTENANCE, REMOVAL, AND RESTORATION

All pollution control measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as near original conditions as practical.

7. SPECIAL SPECIFICATIONS

Items of work and construction to be performed in conformance with this specification and the construction details therefor are:

a. Subsidiary Item, Pollution Control

- (1) This item will consist of applying and performing all construction activities in a manner that will minimize water pollution, air pollution and soil erosion.
- (2) Contractor will be required to install silt fence on the perimeter of the easement boundary at all locations where runoff may exit project site. Silt fence shall be installed prior to disturbing any soil.

Approved sources of silt fence are:

<u>Manufacturer/Distributor</u>	<u>Brand</u>
Belton Industries, Inc.	Style 912
Carthage Mills	Carthage 15%
Fab Tex Solutions, Inc.	SCF 1500 I
Thrace-LINQ Inc.	GTF 400 EO
Propex Inc.	Geo Tex 2132 (cord)
Propex Inc.	Geo 2130D
TenCate Geosynthetics	FF101 (IA)
Hanes Geo Components	Terra-Tex Econofence with netting
Hanes Geo Components	Terra-Tex SC-32 (cord)
Hanes Geo Components	Terra-Tex SC-32 (belt)
Willacoochee Industrial Fabrics, Inc.	Style 1215

Installation of silt fence shall be in accordance with Standard Detail EC-201.

- (3) No separate payment will be made for Pollution Control. Compensation for this item will be included in the payment for: Site Preparation; Mobilization; Steel Sheet Pile; Tile Investigation and Removal; Channel Excavation; Pool Excavation; Core Trench; Earthfill; Topsoil, Strip, Salvage, Respread; Riprap; and Concrete Grout.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-6 SEEDING AND MULCHING FOR PROTECTIVE COVER

1. SCOPE

The work shall consist seeding, mulching, and fertilizing all disturbed areas and other areas as indicated on the drawings or otherwise designated.

2. SEEDBED PREPARATION AND APPLICATION

The entire area to be seeded shall be reasonably smooth and all washes and gullies shall be filled to conform to the desired cross-section before actual seedbed preparation is begun. At this stage of the operation, the required fertilizer and lime shall be applied uniformly and incorporated into the top 3 inches of the soil with suitable tillage equipment. The seedbed preparation operation shall be suspended when the soil is too wet or too dry. The seedbed shall be loosened to a depth of at least three inches.

On side slopes steeper than 2-1/2 horizontal to 1 vertical, the 3 inch minimum depth of seedbed preparation is not required, but the soil shall be worked enough to insure sufficient loose soil to provide adequate seed cover.

Unless otherwise specified, the seeding operation shall be performed immediately after preparation of the seedbed. The seed shall be drilled or broadcast by equipment that will insure uniform distribution of the seed.

3. MATERIALS

The seeding, fertilizing, and mulching requirements are as specified on Form IA-CPA-4.

Straw from cereal grains or hay will be used as mulching material. It shall be relatively free of weeds.

4. MULCH APPLICATION

The required mulching shall be performed as soon as possible after seeding unless otherwise specified. The mulch shall be applied uniformly over the area. The type and rate shall be as specified. When mulching is required, all areas seeded during any one day shall be mulched within 24 hours. The mulch may be spread by any means that results in a uniform cover.

The mulch shall be anchored. Anchoring of the mulch may be performed by a mulch anchoring tool or regular farm disk weighted and set nearly straight, by installation of mulch netting, or by other methods approved by the Engineer.

5. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, each area treated is measured as specified in section 6 and the area calculated to the nearest 0.1 acre.

Payment for treatment is made at the contract unit price for the designated treatment, which will constitute full compensation for completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the item(s) to which they are made subsidiary are identified in section 6.

6. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 2, Structure Seeding

- (1) This item will consist of seeding the dike except the upstream sideslope below elevation 1126.0, the auxiliary spillway, and all side slopes of excavated channels.
- (2) All seed must be cleaned and weed free. Seeding rates are expressed in bulk pounds per acre. Seed quality shall not drop below 70% Pure Live Seed (PLS) where $PLS = (\text{percent germination} + \text{percent dormant seed}) \times \text{percent purity}$.
- (3) Seeding rates are as follows:

Smooth Brome grass	25 lbs./ac.
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- (4) Seed shall be applied with a drill and placed at $\frac{1}{4}$ to $\frac{1}{2}$ inch deep.
- (5) Fertilizer shall be applied on the entire seeding area at the following rate:

Nitrogen	30 lbs./ac.
Phosphorus (P ₂ O ₅)	30 lbs./ac.
Potassium (K ₂ O)	40 lbs./ac.

No lime is needed.
- (6) Straw mulch shall be applied at the rate of 2 tons per acre. The contractor shall submit scale tickets for straw mulch.
- (7) Seeding will be completed during the following seeding periods:

Spring	March 1 to May 15
Summer	August 1 to September 15
Fall	November 15 to freeze-up

If construction is completed during any other time of the year, the seeding shall be performed at the next seeding period.

- (8) If seeding is completed during the spring seeding period, a companion crop of oats shall be seeded at a rate of one and one-half bushels per acre.
- (9) Measurement will be based on the horizontal area successfully seeded. Areas unsuccessfully seeded due to actions of the contractor shall be repaired by the

contractor at his expense.

b. Bid Item 3, Buffer Seeding

- (1) This item will consist of seeding all areas within the easement boundary, except the normal pool area, the sediment basin below elevation 1126.0 and those areas seeded by Bid Item 2.
- (2) All seed must be cleaned and weed free. All seed must be yellow tagged Iowa ecotype.
- (3) Seeding mixture shall include a minimum of 5 native grasses and 10 native forbs. The mixture shall provide a minimum of 30 grass seeds per square foot and 10 forbs seeds per square foot. Number of seeds will be based on Table 3 in NRCS Standard 327 "Conservation Cover". Companion crop for buffer seeding shall be in accordance with NRCS Standard 327. Contractor's proposed seed mix shall be submitted to the Engineer for approval at least 2 weeks before seed is applied.
- (4) Seeding will be completed during the following seeding periods:

Spring	April 15 to July 1
Fall	November 15 to freeze-up
- (5) Seeding may be applied directly using a no-till native seed drill or prepare a firm seedbed for all other planting methods, as follows:
 - (a) If the land was in soybeans, no additional tillage is required. If the land was in corn or other vegetation, till all areas to be seeded by disking or other approved method; thoroughly loosen and pulverize the soil to a depth of three (3) inches. This may require multiple passes of the disk or other approved equipment.
 - (b) If the land is currently pasture with a smooth surface, the preparation shall include mowing any vegetation taller than 12 inches and applying a burn down herbicide, such as Glyphosate, at the labeled rates to the emergent growth two to four (4) weeks after mowing. If the pasture has a rough surface that would impact seeding, the area shall be disked thoroughly and cultipacked. A burn down herbicide, such as Glyphosate, shall be applied to emergent growth. Seeding shall not occur until after the existing vegetation has died, usually about one (1) week.
 - (c) After the disking operation, and prior to seed application, firm the seedbed with a cultipacker or similar piece of equipment.
- (6) No lime or fertilizer will be applied.
- (7) Sow seed with the contour using a drill set for the specified seeding rates. The drill shall be equipped with double coulter furrow openers. The drill shall be subject to acceptance by Engineer. Overlap each successive seeding pass to ensure complete coverage.
- (8) Plant seed no more than one-quarter inch deep; some seed may be seen on the

surface after seeding.

- (9) Broadcasting by centrifugal-type of hydroseeder broadcasters, or by hand shall also be allowed in areas not accessible to drills or other equipment. Once broadcast, the seed must be covered with soil to a depth no greater than one quarter ($1/4$) inch by means of hand rakes or other approved methods.
- (10) Upon completion of the seeding operation, cultipack the seedbed to provide a positive seed-soil contact. If the drill seeder is equipped with an approved cultipacker or press wheels, separate operations shall not be necessary. The type of cultipacker/seeder to be used shall be subject to acceptance by the Engineer.
- (11) No mulch will be applied.
- (12) Measurement will be based on the horizontal area successfully seeded. Areas unsuccessfully seeded due to actions of the contractor shall be repaired by the contractor at their expense.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-8 MOBILIZATION AND DEMOBILIZATION

1. SCOPE

This work shall consist of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

The work shall not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract.

Mobilization will not be considered as work in fulfilling the contract requirement for commencement of work.

2. EQUIPMENT AND MATERIALS

Mobilization shall include all activities and costs for transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities for the Contractor's operations at the site; premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable; and other items specified in Section 4.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not included in the contract form the site; including the disassembly, removal and site cleanup of offices, buildings, and other facilities assembled for this contract.

The work includes mobilization and demobilization activities required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted or added items of work for which the contractor is entitled to an adjustment in contract price, compensation of such costs will be included in the price adjustment for the item or items of work changed or added.

3. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the contractor showing specific mobilization and demobilization costs and evidence of the charges of suppliers, subcontractors, and others. If the total of such payments is less than the lump sum contract price, the unpaid balance will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for the completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the cost of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 4, Mobilization

- (1) Any work that is necessary to provide access to the site including, but not limited to, grading and temporary culverts will be included in this item. When construction is completed access areas will be restored, as close as practical, to their original condition, including seeding of disturbed areas outside of the construction limits.
- (2) The Contactor shall exercise caution to minimize the amount of damage caused by the grading and clearing operations.
- (3) Portable toilets shall be provided at the construction site and used for the sanitary facilities.
- (4) Contractor shall notify One-Call (1-800-292-8989) for utility locates prior to commencing work.
- (5) Contractor is to use due caution in working over and around all tile lines. The contractor shall ensure there is a minimum of 2 feet of cover over tile lines prior to crossing with construction equipment. Breaks in the tile line due to the Contractor's carelessness are to be replaced at his expense without cost to the Project Owner. Any tile lines broken or disturbed by cut lines will be replaced as directed by the Engineer in charge of construction and at the Project Owner's expense.
- (6) All borrow areas, stockpile areas, haul roads and areas for maneuvering equipment shall receive subsoil tillage to a depth of 18 to 24 inches.
- (7) This item shall not include transportation of personnel, equipment and operating supplies within the work limits of this contract.
- (8) Payment will constitute full compensation for the following related subsidiary item: Pollution Control.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-11 REMOVAL OF WATER

1 SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the plans and specifications.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain and operate all cofferdams, channels, diversions, flumes, sumps, and other temporary protective works needed to divert surface water away from the construction site while construction is in progress.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches, borrow areas and other parts of the construction site shall be dewatered as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all works and equipment needed to perform the dewatering.

4. EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

5. REMOVAL OF TEMPORARY WORKS

After temporary works have served their purposes and before the Contractor leaves the site, they shall be removed.

6. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Subsidiary Item, Removal of Water

- (1) This item shall consist of diverting surface water and dewatering the site as needed for construction.
- (2) No separate payment will be made for Removal of Water. Compensation for this item will be included in the payment for: Steel Sheet Pile; Tile Investigation and Removal; Channel Excavation; Pool Excavation; Core Trench; Earthfill; Corrugated Metal Pipe, 18 In.; Water Control Structure, 48 In.; Riprap; and Concrete Grout.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-13 SHEET PILING

1. SCOPE

The work shall consist of furnishing and driving the specified sheet piling at the location shown on the drawings.

2. MATERIALS

Sheet piling shall conform to the requirements of ASTM A328 (Steel Sheet Piling), A572 (High-Strength Low-Alloy Columbium-Vanadium Structural Steel), or A690 (High-Strength Low-Alloy steel H-Piles and Sheet Piling for Use in Marine Environments). The sheet piling provided shall meet the required cross-section, section modulus, thickness, and steel grade shown on the drawings. Fabrication of sheet piles from shorter lengths of pile stock is not permitted.

3. DRIVING SHEET PILE

The piling shall be driven in a manner so as to insure perfect interlocking throughout the entire length of each pile. The piles shall be held in proper alignment during driving by means of suitable temporary guide structures which shall be removed when they have served their purpose.

Piling shall be driven to the full depth shown on the drawings unless otherwise approved by the engineer.

4. CUTTING OFF PILES

The contractor shall cut the piling off at the specified elevations. Piling length shall be sufficient to permit removal of all materials damaged by driving.

5. DEFECTIVE PILING

Any piling damaged in driving, driven out of its proper location, driven below the specified cut off elevation, or inaccurately cut off shall be pulled and replaced or re-driven. Any piling ruptured in the interlock or otherwise damaged during driving shall be pulled and replaced.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the area of sheet pile walls, acceptably placed in accordance and within the neat lines shown on the drawings, is computed to the nearest square foot. Payment is made at the contract unit price for each type, kind, and weight of piling. Such payment will constitute full payment for all labor, equipment, materials, and other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

7. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 5, Steel Sheet Pile

- (1) This item shall consist of furnishing and installing the steel sheet piling as shown on the drawings. This item shall include field cutting the sideslopes of the sheet piling to the slope shown on the drawings.
- (2) Complete earthfill within 20 feet of sheet piling before driving sheet piling.
- (3) The sheet piling will be installed starting from the center of the weir section and progressing away from centerline.
- (4) Sheet piling shall have the following requirements:
 - (a) Minimum section modulus of 19.25 cu. in. per foot of length.
 - (b) Minimum web thickness of 0.375 inches.
 - (c) Minimum grade of steel shall be 36 ksi.

The contractor shall submit material certifications to the Engineer for approval.

- (5) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; Removal of Water; and Structure Excavation.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-21 EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials. The cutoff trench and any other required excavations shall be dug to the lines and grades shown on the drawings or as staked in the field. Structure or trench excavations will conform to all safety requirements of OSHA.

2. USE OF EXCAVATED MATERIALS

Suitable materials from the specified excavations shall be used in the construction of required permanent earth fill. The suitability of materials for specific purposes shall be determined by the Engineer.

3. DISPOSAL OF WASTE MATERIAL

All surplus or waste material shall be disposed of in areas shown on the drawings or as approved by the Engineer. The waste material shall be smoothed and sloped to provide drainage.

4. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavations will conform to all safety requirements of OSHA.

5. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas as shown on the drawings or as approved by the Engineer. On wetland projects, borrow shall not be taken from the wetland area within 10 feet of the embankment or as shown on the drawings.

Borrow areas shall be excavated and grading completed in a manner to eliminate steep or unstable side slopes or hazardous or unsightly conditions.

6. OVER-EXCAVATION

Excavation beyond the specified lines and grades shall be corrected by filling the resulting voids with compacted earthfill, except that if the earth is to become the subgrade for riprap, sand or gravel bedding or drainfill, the voids shall be filled with material conforming to the specifications for the riprap, bedding or drainfill, as appropriate.

7. MEASUREMENT AND PAYMENT

For items of work for which lump sum prices are established in the contract, the quantity of work will not be measured for payment. Payment for each item will be made at the contract lump sum price and will constitute full compensation for completion of the work.

For items of work for which specific unit prices are established in the contract, the volume of excavation within the specified pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas or by methods outlined in section 8 of this specification. Regardless of quantities excavated, the measurement for payment is made to the specified pay limits except that excavation outside the specified lines and grades directed by the engineer to remove unsuitable material is included. Excavation required because unsuitable conditions result from the contractor's improper construction operations, as determined by the engineer, is not included for measurement and payment.

Payment for excavation is made at the contract unit price. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work except that extra payment for backfilling overexcavation will be made in accordance with the following provisions.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

8. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefore are:

a. Bid Item 6, Tile Investigation and Removal

- (1) This item will consist of the excavation necessary to locate and remove any tile under the dike.
- (2) The investigation should reveal where the tiles cross the dike line or where they are located if they don't cross the dike line. The tiles will be removed only if they cross the dike line.
- (3) All tiles under the dike shall be removed from a point 15 feet upstream of the upstream toe of the dike to 100 feet downstream of the dike centerline.
- (4) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; Removal of Water; and Backfill of Required Excavation.

b. Bid Item 7, Channel Excavation

- (1) This item will consist of the excavation for the outlet channel for the water control structure, the sediment basin channel, and for the plunge pool for the sheet pile structure. The quantity includes excavation required to install all riprap as detailed

on the drawings.

- (2) The excavated material may be used within the dike if the material is suitable earthfill material. All surplus or unsuitable excavated material may be disposed of on-site as directed by the Engineer.
- (3) Payment will be based on plan quantity.
- (4) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; and Removal of Water.

c. Bid Item 8, Pool Excavation

- (1) This item will consist of excavating from the designated borrow areas shown on the drawings for the purpose of enlarging the pool area.
- (2) The excavated material may be used to backfill the core trench and construct the dike if the material is suitable earthfill material. Unsuitable earth material shall be wasted within the pool area below elevation 1123.0 and graded smooth as shown on the typical waste section on plan sheet 2.
- (3) The borrow areas within the pool shall be over excavated to an elevation 6 inches below finished grade to allow for respreading of topsoil.
- (4) Payment will be based on plan quantity.
- (5) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; and Removal of Water.

d. Subsidiary Item, Borrow Excavation

- (1) This item shall consist of obtaining suitable on-site borrow material for use as earthfill.
- (2) A minimum of six inches of topsoil shall be stripped, salvaged and respread on all borrow areas.
- (3) No separate payment will be made for Borrow Excavation. Compensation for this item will be included in the payment for: Core Trench; and Earthfill.

e. Subsidiary Item, Structure Excavation

- (1) This item shall consist of the excavation necessary to install the steel sheet pile, corrugated metal pipe conduit and water control structure in the locations and as shown on the drawings.
- (2) No separate payment will be made for Structure Excavation. Compensation for this item will be included in the payment for: Steel Sheet Pile; Corrugated Metal Pipe, 18 In.; Water Control Structure, 48 In.; Stop Log Storage Structure; and Riprap.

NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

IA-23 EARTHFILL

1. SCOPE

The work shall consist of the construction of earth fills required by the drawings and specifications. The completed work shall conform to the lines, grades, and elevations shown on the drawings or as staked in the field.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. Fill materials shall contain no sod, brush, roots or other bio-degradable materials. Rocks larger than 6 inches in diameter shall be removed prior to compaction of the fill.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped a minimum of 6 inches to remove vegetation and other unsuitable materials. Foundation surfaces shall be scarified to a minimum depth of 2 inches prior to placing fill material.

Foundation and abutment surfaces shall not be sloped steeper than 1.5 horizontal to 1 vertical unless otherwise shown on the drawings.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by NRCS. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Adjacent to structures or pipes, fill shall be placed in a manner which will prevent damage. The height of the fill adjacent to structures or pipes shall be increased at approximately the same rate on all sides.

The materials used throughout the earth fill shall be essentially uniform. Selective placement shall be as shown on the drawings or approved by the Engineer.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified to a minimum depth of 2 inches before the next layer is placed.

The top surfaces of embankments shall be maintained approximately level during construction, except that a cross-slope of approximately 2% shall be maintained to ensure effective drainage.

When moving fill material from the borrow area(s) to the embankment by use of bulldozers only, the following steps shall be followed:

- Immediately after the borrow material is pushed to the embankment, it shall be spread in horizontal lifts placed parallel to the centerline of the embankment.
- Compactive effort will then be applied by operating equipment parallel to the centerline of the fill or embankment.
- Lift thicknesses shall be in strict compliance with Clause 6, below.

Sectional fills are not allowed unless they are shown on the construction drawings.

5. CONTROL OF MOISTURE CONTENT

The moisture content of the fill material shall be adequate for obtaining the required compaction. Material that is too wet shall be dried to meet this requirement, and material that is too dry shall have water added and mixed until the requirement is met.

The moisture content of the fill material shall be such that a ball formed with the hands does not crack or separate when struck sharply with a pencil and will easily ribbon out between the thumb and finger.

Earth foundations under and adjacent to concrete structures shall be prevented from drying and cracking before concrete and backfill are placed.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as possible.

6. COMPACTION

Earth fill shall be compacted by one of the following methods as specified on the plans or in Section 9, Special Specifications. If no method is specified, compaction will be in accordance with Method 1.

- Method 1 - Earthfill shall be placed so that the wheels or tracks of the loaded hauling equipment, traveling in a direction parallel to the centerline of fill, pass over the entire surface of each layer being placed. Low ground pressure vehicles shall not be used for this purpose.
- Method 2 - Two (2) complete passes of a tamping-type roller will be made over each layer. The roller shall be capable of exerting a minimum force of two hundred (200) pounds per square inch.
- Method 3 - Minimum density shall be 90% of the maximum density as determined by ASTM D 698 and as shown on the plans.

The maximum thickness of a lift of fill before compaction shall be 9 inches, unless otherwise indicated on the drawings.

Fill adjacent to structures, pipe conduits, and appurtenances shall be placed in layers not more than 4 inches thick and compacted to a density equivalent to that of the surrounding fill. Methods used to obtain compaction for fine or coarse grained materials are as follows:

- For fine grained materials, hand tamping or manually directed power tampers may be used. Hand compaction only shall be used to compact the earthfill under the bottom half of circular pipes. Manually directed power tampers shall not be used in tight spaces where applying full compactive effort will result in direct contact of the tamper plate with the pipe. Care should be taken so that compaction around the spillway pipe does not cause uplift of the pipe resulting in a void beneath the pipe.
- For coarse grained materials (sands and gravels), vibratory plate compactors shall be used for obtaining compaction. However, hand tamping shall be used to compact the material under the bottom half of circular pipes.

In all cases, follow manufacturer instructions for the specific compaction equipment being used. Heavy equipment shall not be operated within 2 feet of any structure or pipe.

Compacting of fill adjacent to concrete structures shall not be started until the concrete is 7 days old.

7. ISLANDS, MOUNDS, AND LOAFING AREAS ON WETLAND RESTORATION, ENHANCEMENT, OR CREATION PROJECTS

Islands shall be randomly located within the wetland area at locations shown on the drawings or as staked in the field. The orientation of island shorelines shall be random with attention given to prevailing winds to limit wave damage. In general, the side of the island with the longest dimension shall be parallel to the prevailing wind direction. Side slopes of islands shall be as shown on the drawings, but in no case shall be steeper than 6 horizontal to 1 vertical. Island shapes shall be irregular.

Loafing areas shall be constructed in the areas shown on the drawings or as staked in the field and shall be graded to drain runoff water. The elevation of at least one loafing area should be above the maximum water level whenever possible.

Excavated material not suitable for embankments, wetland dikes, or islands can be used to create mounds or blended into surrounding topography to create a natural appearance. Spoil material shall not be spread on existing wetland areas.

Organic soils shall not be used to construct islands, loafing areas, dikes, or embankments.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill and earth backfill within the specified zone boundaries and pay limits is measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified in section 9, no deduction in volume is made for embedded items, such as, but not limited to, conduits, inlet structures, outlet structures, embankment drains, sand diaphragm and outlet, and their appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only under the following conditions:

- Where such overexcavation is directed by the engineer to remove unsuitable material, and
- Where the unsuitable condition is not a result of the contractor's improper construction operations as determined by the engineer.

Earthfill beyond the specified lines and grades to backfill excavation required for compliance with OSHA requirements will be considered subsidiary to the earthfill bid item(s).

Payment for each type and compaction class of earthfill and earth backfill is made at the contract unit price for that type and compaction class of earthfill. Such payment will constitute full compensation for all labor, material, equipment, and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8 of this specification.

9. SPECIAL SPECIFICATIONS

Items of work to be performed in accordance with this specification and the construction details therefor are:

a. Bid Item 9, Core Trench

- (1) This item shall consist of the excavation and earthfill necessary to construct the core trench as shown on the drawings.
- (2) Quantity includes 1923 C.Y. of excavation, 2596 C.Y. of fill plus 35% shrink and 673 C.Y. of borrow.
- (3) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; Removal of Water; and Borrow Excavation.

b. Bid Item 10, Earthfill

- (1) This item shall consist of the earthfill necessary to construct the sheet pile structure dike.
- (2) Borrow from suitable channel and pool excavation. Additional necessary borrow shall be obtained from on-site borrow areas as directed by the engineer.
- (3) Rocks larger than 6 inches shall be removed prior to compaction of the fill and placed in the waste area.
- (4) Compaction shall be Method 1.
- (5) Payment for these items shall be based on plan quantity. Plan quantity includes 35% shrink.

- (6) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; Removal of Water; and Borrow Excavation.

c. Subsidiary Item, Backfill of Required Excavation

- (1) This item shall consist of the backfilling the areas excavated to install the corrugated metal pipe and water control structure and to locate and remove tile lines.
- (2) Compaction of fill adjacent to the structures shall be as indicated above in section 6. All other compaction shall be Method 1.
- (3) No separate payment will be made for Backfill of Required Excavation. Compensation for this item will be included in the payment for: Tile Investigation and Removal; Corrugated Metal Pipe, Tile Outlet, 10 In.; Corrugated Metal Pipe, 18 In.; Water Control Structure, 48 In; and Stop Log Storage Structure.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-26 TOPSOILING

1. SCOPE

The work shall consist of salvaging topsoil from borrow areas or required excavations and spreading it on the exposed disturbed areas.

2. QUALITY OF TOPSOIL

Topsoil shall consist of friable surface soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

3. EXCAVATION

After the site has been cleared and grubbed, the topsoil shall be removed from borrow areas and required excavation areas to the depth as shown on the drawings. Topsoil shall be stockpiled at locations approved by the Engineer.

4. SPREADING

Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces designated to be covered shall be lightly scarified just prior to the spreading operation. Where compacted fills are designated to be covered by topsoil, the topsoil shall be placed concurrently with the fill and shall be bonded to the compacted fill with the equipment.

Topsoil shall be placed to the minimum depth shown on the drawings. After the spreading operation is completed, the surface shall be finished to a reasonably smooth surface.

5. SPECIAL SPECIFICATIONS

Items of work to be performed in accordance with this specification and the construction details therefor are:

a. Bid Item 11, Topsoil, Strip, Salvage, Respread

- (1) This item shall consist of removing and stockpiling six inches of topsoil from any area in which excavation or earthfill is required and resspreading the stockpiled topsoil on the completed excavation and earthfill.
- (2) All material suitable to be used as topsoil shall be stockpiled.
- (3) Topsoil shall be placed to a minimum depth of six inches. Areas of excavation shall be overexcavated 6 inches to allow for resspreading of topsoil.
- (4) The volume of topsoil is computed on the basis of a uniform 6 inch cut over the

designated areas of excavation and earthfill.

- (5) Topsoil salvaged from excavation and earthfill areas and paid for as Topsoil, Strip, Salvage, Respread will not be included in excavation or earthfill quantities for which payment is made.
- (6) Payment for Topsoil, Strip, Salvage, Respread will be made at the contract unit price per cubic yard. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work.
- (7) Payment will constitute full compensation for the following related subsidiary item: Pollution Control.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-32 CONCRETE FOR NONSTRUCTURAL SLABS

1. SCOPE

The work shall consist of forming, placing, finishing, and curing Portland cement concrete slabs including steel reinforcement.

2. MATERIALS

Portland Cement shall be Type I or Type II Portland cement.

Air entraining agents shall conform to ASTM C 260.

Fly ash may be used as a partial substitution for Portland cement and shall be in strict compliance with ASTM C 618, Class F or C. The loss by ignition shall not exceed 4.0 percent.

Blast-furnace slag may be used as a partial substitution for Portland cement and shall be in conformance with ASTM C 989 for ground granulated blast-furnace slag (GGBF slag).

Water-reducing admixtures shall conform to ASTM C 494 and may be of Type A, D, F or G. Type D or G admixtures may be used when the air temperature is over 80 degrees F. at the time of mixing and/or placement.

Preformed expansion joint filler shall be a commercially available product made of bituminous, sponge rubber or closed cell foam materials with a minimum thickness of 1/2 inch.

Coarse and Fine Aggregate shall conform to ASTM C 33 and shall be clean, hard, durable and free from clay or coating of any character. The maximum size of coarse aggregate shall be 1 1/2 inches or as shown on the drawings.

Reinforcing steel shall be deformed billet-steel bars, Grade 40 or 60. Welded wire fabric shall conform to the requirements of ASTM A 185.

Water shall be clean and free of harmful chemicals.

Calcium Chloride or other antifreeze compounds or accelerators will not be allowed.

3. CONCRETE MIX

The concrete mix shall provide a minimum strength of 3500 psi at 28 days. The mix shall contain not less than 6 sacks of cement per cubic yard and not more than 5.6 gallons of water per sack of cement. The water/cement ratio shall not exceed 0.50 including free water in the aggregates. Air entrainment shall range from 4% to 8%. The slump shall be 2 to 5 inches except when superplasticizer is used. The slump shall be 3 inches or less prior to the addition of superplasticizer admixture and shall not exceed 7 1/2 inches following addition and mixing.

The contractor shall be responsible for determining the design mix proportions and shall provide a copy of the mix to the Engineer at least 3 days prior to placing any concrete. A concrete batch ticket shall be supplied to the Inspector at the time of delivery to the site. The minimum information to be included shall be the name of the supplier, size of load, time of loading, type and amount of cement, type and amount of admixtures, saturated surface dry weights of fine and coarse aggregate, mixing water added at the plant and free water in aggregates.

4. REINFORCING STEEL

Reinforcing steel shall be free from loose rust, concrete, oil, grease, or paint.

Reinforcing shall be accurately placed and secured in position in a manner that will prevent its displacement during placement of concrete. The use of heat or welding in cutting, bending and splicing of reinforcing steel will not be permitted.

In slabs, steel shall be supported by precast concrete bricks, corrosion resistant metal chairs, or non-metal chairs. The concrete brick shall have strength equal to or greater than 3500 psi. Metal chairs shall have a protective epoxy coating, plastic coating, galvanized finish or be stainless steel.

Splices of reinforcing bars shall be lapped 30 diameters but not less than 12 inches. Bars shall not be spliced by welding. Welded wire fabric shall be lapped at least one mesh width.

5. SUBGRADE

The subgrade shall be excavated or filled with suitable material to produce the required subgrade elevation(s). Subgrade materials shall be blended or unsuitable materials removed and replaced as required to obtain uniform materials, moisture and compaction. Fill sections shall be thoroughly compacted in layers to the specified density and shall extend a minimum of 1 foot beyond the form lines. The subgrade shall be uniformly smooth, moist, dense, and free of ruts, frost, mud and standing water prior to placement of concrete.

If the above requirements for subgrade cannot be achieved using in-place materials, a granular base shall be provided, as specified or shown on the drawings. Granular base shall be well compacted, meeting all requirements for subgrade listed in the preceding paragraph.

Grading tolerances for the finished subgrade (or granular base, if used) shall be a maximum of ¼ inch above grade to ½ inch below grade. If granular base is provided between the subgrade and the concrete, grading tolerances for the subgrade shall be plus or minus 0.1 foot.

6. FORMS FOR CONCRETE

All edges shall be formed. All forms shall be true to line and grade, mortar tight, and rigid. Forms shall be left in place for a minimum of 24 hours.

7. PLACING CONCRETE

Concrete shall not be placed until the subgrade, granular base, forms, and steel reinforcement have been inspected and approved by the Inspector. Any deficiencies are to be corrected before the concrete is delivered for placement.

Concrete shall be placed in final position within one and one-half hours after mixing the aggregate with cement and shall be consolidated by spading or mechanical vibration. The concrete shall not be forced to flow laterally to its final location. Concrete shall not be dropped more than 5 ft. vertically.

Addition of water at the job site may be done at the beginning of placement of each load of concrete in order to obtain allowable slump, provided that the specified water/cement ratio will not be exceeded. Addition of water will not be permitted after placement of the load has proceeded.

Concrete shall be placed at air temperatures between 40oF and 80oF, unless special measures are taken to protect the concrete. Review special concrete placement procedure with NRCS prior to placement of concrete. Concrete shall be protected from freezing for 7 days after placement.

8. JOINTS

Install joints as shown on the drawings. A formed construction joint shall be made at the locations shown on the drawings, at the end of the day or at any time when a cold joint would occur.

Control joints are required every 12.5 to 15 ft. in both directions, unless otherwise shown on the drawings. They shall be tooled or sawed to a depth of 1/4 of the slab thickness.

9. CURING CONCRETE

Concrete shall be cured for 7 days by either:

- a. Applying white pigmented curing compound at a rate of 1 gallon per 150 square feet or as recommended by the manufacturer.
- b. Water soak exposed surface for the entire 7 days.
- c. Cover with burlap, mats or other material and maintain in a moist condition.
- d. Cover with 4 mil plastic sheeting while concrete is still wet.

10. SPECIAL SPECIFICATIONS

Items of work and construction to be performed in conformance with this specification and construction details therefore are:

a. Subsidiary Item, Concrete

- (1) This item consist of all necessary concrete, reinforcing steel, formwork, materials and labor needed for supplying and constructing the concrete footing for the Water Control Structure as shown on the plans.

- (2) No separate payment will be made for Concrete. Compensation for this item will be included in the payment for: Water Control Structure, 48 In.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-46 TILE DRAINS FOR LAND DRAINAGE

1. SCOPE

The work shall consist of furnishing and installing drainage pipe (tubing) and tile and the necessary fittings and appurtenances.

2. MATERIALS

Concrete drain tile shall conform to the requirements of ASTM C 412 and clay drain tile shall conform to the requirements of ASTM C 4.

Corrugated polyethylene (PE) pipe (tubing) and fittings shall conform to ASTM F 405 (3" to 6") or F 667 (3" to 24"), as appropriate. Corrugated profile wall (dual wall) polyethylene (PE) pipe shall meet or exceed requirements of ASTM F 2648 (2" to 60") or ASTM F 2306 (12" to 60"). Pipe conforming to AASHTO M 252 (3" to 10"), or AASHTO M 294 (12" to 60") is acceptable. Perforated tubing shall have a water inlet area of at least 1 square inch per foot, provided by perforations spaced uniformly along the long axis of the tubing. The perforations shall be circular or slots. Circular perforations shall not exceed 3/16 inch in diameter. Slots shall not be more than 1/8 inch wide.

3. EXCAVATION

Unless otherwise specified, excavation for and subsequent installation of each drain line shall begin at the outlet end and progress upstream.

The trench or excavation for the conduit shall be constructed to the line, depth, cross section, and grade shown on the drawings or as directed by the Engineer. The trench bottom shall be smooth and free of exposed rock. If rock is encountered in the trench bottom, over-excavate the trench and place at least 6 inches of compacted earth or sand bedding in the trench to bring it up to the conduit grade.

If not otherwise shown on the drawings, trench width at the top of the conduit shall be the minimum required to permit installation and provide bedding conditions suitable to support the load on the conduit, but with not less than three (3) inches of clearance on each side of the conduit. Maximum trench width shall be the conduit diameter plus 12 inches measured at the top of the conduit, unless approved bedding is installed.

Trench shields, shoring and bracing, or other methods, necessary to safeguard the workers and work, and to prevent damage to the existing improvements shall be furnished, placed, and subsequently removed by the contractor.

Plow installation is allowed. Minimum trench width shall be two (2) inches wider than the conduit on each side. Grade control and bedding conditions shall be closely inspected during plow installation. Boulders, cobbles, or cemented soils can cause the plow to jump and lose grade. These hardpoints can also puncture or dimple and deform the pipe.

4. PREPARING THE BEDDING

Unless otherwise specified, no filter or envelope is required. In stable soils, the bottom of the trench shall be shaped to form a semicircular, trapezoidal, or 90 degree "V" groove in its center. The groove shall be shaped to fit the size of tile. The 90-degree "V" groove shall not be used on conduits greater than 6 inches in diameter.

If the bottom of the trench does not provide a sufficiently stable or firm foundation for the drain tile, a sand-gravel mix or other approved materials shall be used to stabilize the bottom of the trench.

5. FILTER OR ENVELOPE MATERIAL

When a filter is specified, the shape of the bottom of the trench, gradation and the thickness of the filter or envelope material to be placed around the conduit will be as shown on the drawings. The envelope or filter material shall be placed in the bottom of the trench just prior to the laying of the conduit. The conduit shall then be laid and the envelope or filter material placed over the conduit.

6. PLACEMENT AND JOINT CONNECTIONS

All drains shall be laid to grade.

Joints between lateral concrete and clay drain tile shall vary with soil type as follows:

- a. Peat and muck – 1/4 inch preferred, 3/8 inch maximum
- b. Clay – 1/8 inch preferred, 1/4 inch maximum
- c. Silt and loam – 1/16 inch preferred, 1/8 inch maximum
- d. Sand – tightest possible fit

Joint between main drain tile which serve only to collect and transport drainage water from lateral tile lines should be the tightest fit possible.

Where the joint width exceeds the maximum above, the joint shall be covered with a permanent type material such as coal tar pitch treated roofing paper, fiber glass sheet or mat, or plastic sheet.

After placement and binding of plastic tubing, but prior to backfilling, sufficient time shall elapse to allow the tubing to reach the ambient temperature of the trench. All split fittings shall be securely tied with nylon cord before backfill is placed. When corrugated plastic tubing is used, no more than 5% stretch will be allowed.

7. CONNECTIONS

Lateral connections will be made with manufactured appurtenances (wyes, tees, etc.) comparable in strength and durability with the specified conduit unless otherwise shown on the drawings.

Existing drain lines not shown on the drawings but encountered during installation shall be bridged across the trench or connected into the new line, as directed by the Engineer.

8. OUTLETS

A continuous section of non-perforated conduit at least 20 feet long shall be used at the outlet. At least two-thirds of the outlet pipe shall be buried in the ditch bank, and the cantilever section must extend to the toe of the ditch side slope or the side slope protected from erosion. Acceptable materials for use at the outlet including the following:

- a. Corrugated metal pipe, galvanized or aluminum, 16 gauge minimum;
- b. Smooth steel pipe with a minimum wall thickness of 3/16 inch;
- c. Smooth plastic pipe, polyvinyl chloride (PVC), with a SDR of 26 or less or schedule 40 or heavier; or
- d. Corrugated profile wall (dual wall) polyethylene pipe (PE).

All plastic (PVC) and polyethylene pipe (PE) outlets shall include ultra-violet stabilizer. PVC and PE pipe outlets shall not be used where burning vegetation on the outlet ditch bank is likely to create a fire hazard.

The outlet shall be equipped with a flap-gate type rodent guard.

9. BLINDING

After the conduit is placed in the excavated groove, friable material from the sides of the trench shall be placed around the conduit, completely filling the trench to a depth of not less than six (6) inches over the top of the conduit. For material to be suitable it must not contain hard clods, rocks, frozen soil, or fine material which will cause a silting hazard to the drain. Conduit placed during any one day shall be blinded by the end of the day's work.

10. BACKFILLING

The backfilling of the trench shall be completed as rapidly as consistent with the soil conditions. Automatic backfilling machines may be used. Backfill shall extend above the ground surface and be well rounded over the trench.

Unless otherwise shown on the plans, in mineral soils, the minimum depth of cover subsurface drains shall be 2.4 feet. In organic soils, the minimum depth of cover after initial subsidence shall be 3.0 feet.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each kind and size of tile or tubing is determined to the nearest foot of length measured along the centerline of the installed tile or tubing. Payment for each kind and size of tile or tubing will be made at the contract unit price for that kind and size of tile or tubing. Such payment constitutes full compensation for furnishing, transporting and installing the tile or tubing including excavation, shoring, geotextile or granular fill (when specified), backfill and all fittings, appurtenances and other items required to complete the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for the sizes and types of appurtenances listed.

Compensation for any item of work described in the contract but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the bid items to which they are made subsidiary are identified in Section 12 of this specification.

12. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 12, CPT, 8 In. Non-Perforated

1. This item will consist of furnishing and installing the corrugated polyethylene tubing (CPT) to outlet the tile line.
2. The 8" CPT shall be non-perforated.
3. The tubing shall be connected to the existing tile line in a manner which insures that drainage will not be obstructed and the surrounding soil will not enter through the connection.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-51 CORRUGATED METAL PIPE CONDUITS

1. SCOPE

The work shall consist of furnishing and placing circular, arched or elliptical corrugated metal pipe and the necessary fittings.

2. MATERIALS

Metallic-coated steel corrugated pipe and fittings shall be zinc-coated or aluminized, Type 2, and shall conform to the requirements of ASTM A 760 and A 929 for the specified type and size of pipe. Aluminum corrugated pipe shall conform to the requirements of ASTM B 745 for the specified type and size of pipe. All pipe is subject to the following additional requirements:

- a. When polymer coating is specified, pipe, coupling bands and anti-seep collars shall be coated in accordance with ASTM A 762. All riveted joints shall be caulked as described in paragraph b.
- b. Pipe with annular corrugations shall be furnished with caulked seams. Riveted pipe joints shall be caulked with a bituminous mastic material during fabrication to provide a watertight joint. All circumferential and longitudinal seams shall be caulked before riveting. This shall be accomplished by applying a uniform bead of the mastic compound to the inner lap surface before riveting such that when the rivets are in place, all voids are filled and a coating of mastic is between the lap surfaces. The inner surface of coupling bands shall be asphalt coated in the field prior to installation. A neoprene gasket having a minimum thickness of 3/8 inch and a minimum width of 7 inches may be used in lieu of mastic coated coupling bands.
- c. Welded or lock seams in helical corrugated pipe are considered to be watertight.
- d. When close riveted pipe is specified: (1) the pipe shall be fabricated so that the rivet spacing in the circumferential seams shall not exceed 3 inches, except that 12 rivets will be sufficient to secure the circumferential seams in 12-inch pipe, and (2) in those portions of the longitudinal seams that will be covered by the coupling bands, the rivets shall have finished flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.
- e. Double riveting or double spot welding of pipe less than 42 inches in diameter may be required. If specified, the riveting or welding shall be done in the manner specified for pipe 42 inches or greater in diameter.

3. COUPLING BANDS

Coupling bands shall meet the requirements of the table below or have detailed drawings submitted for approval by the Engineer. Coupling bands shall be of the same minimum thickness (gage) as the pipe being connected.

Description of Coupling Band	Maximum Fill Height, Ft.	Maximum Pipe Diam., In.
24-inch wide coupling band with four 1/2-inch Diam. galvanized rods with tank lugs for annular or helical corrugated metal pipe. Bands shall have a minimum lap of 3 inches.	All	All
Hugger band from Armco Steel Corp. for helical corrugated metal pipe with reformed ends and for annular corrugated pipe. Bands include O-ring gaskets and two 1/2-inch Diam. galvanized rods and lugs. ^{1/}	35	48
Hugger band without rods and lugs but including O-ring gaskets. ^{1/}	20	24
Angles riveted or welded to a coupling band and drawn tight with bolts. Bands shall be a minimum of 7 corrugations wide and have a minimum lap of 2 inches.	35	15
Flanged couplings for helical corrugated pipe welded to the ends of the pipe and field assembled by a minimum of 3/8-inch Diam. bolts. A joint sealer shall be placed between the flanges to ensure water tightness.	35	12

^{1/} Use is limited to sites where soft foundation and conduit elongation is not anticipated.

4. FABRICATION

Fabrication of all appurtenances shall be done as shown on the drawings. All appurtenances shall be made of metallic-coated steel when corrugated steel pipe is used and aluminum when used with aluminum pipe. Dissimilar metals shall not be installed in contact with each other.

5. REPAIR OF DAMAGED COATINGS

The Contractor shall place the pipe without damaging the pipe or coatings. The pipe shall be transported and handled in a manner to prevent damage to the pipe or coating.

Breaks, scuffs, or other damage to the various coatings shall be repaired as follows:

- a. Metallic Coating - by thoroughly wire brushing the damaged area and cleaning with solvent, and then painting two coats of one of the following paints:
 - (1) Zinc Dust - Zinc Oxide Primer conforming to ASTM D 79 and D 520.
 - (2) Singles package, moisture cured urethane prime in silver metallic color.
 - (3) Zinc-rich cold galvanized compound, brush, or aerosol applications.
- b. Polymer Coating - apply two coats of polymer material similar to and compatible with the durability, adhesion and appearance of the original polymer coating. The repair coating shall be a minimum thickness of 0.010 (10 mils) after drying and shall bond securely to the pipe.

6. LAYING AND BEDDING THE PIPE

The pipe shall be laid to the line and grade shown on the drawings and shall be firmly and uniformly bedded throughout its entire length. Details of the bedding are as shown on the drawings.

The pipe shall be laid with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides at approximately the vertical mid-height of the pipe. Field welding of corrugated galvanized steel pipe will not be permitted. The pipe sections shall be joined with coupling bands.

7. BACKFILLING

Special care shall be taken during backfill operations not to disturb the grade and alignment. The pipe shall be tied down or loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

Backfill material shall have sufficient moisture so that optimum compaction can be obtained. Backfill around the pipe shall be placed in layers not more than 4 inches thick before compaction.

Each layer of backfill shall be compacted with power tampers, hand tampers, or plate vibrators to the same density requirements as specified for the adjacent embankment. Backfill over and around the pipe shall be brought up uniformly on all sides. The passage of earth moving equipment will not be allowed over the pipe until backfill has been placed above the top of the pipe surface to a depth of two (2) feet.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each type, class, size, and gauge of pipe is determined as the sum of the nominal laying lengths of the pipe sections installed. Payment for each type, class, size, and gauge of pipe is made at the contract unit price for that type, class, size, and gauge of pipe. Such payment constitutes full compensation for furnishing, transporting, and installing the pipe and fittings and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 9 of this specification.

9. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

- a. Bid Item 13, Corrugated Metal Pipe, Tile Outlet, 10 In.
Bid Item 14, Corrugated Metal Pipe, 18 In.
Bid Item 15, Water Control Structure, 48 In.
Bid Item 16, Stop Log Storage Structure

The contractor shall submit material certifications to the Engineer for approval.

- b. Bid Item 13, Corrugated Metal Pipe, Tile Outlet, 10 In.
 - (1) This item consists of furnishing and installing the corrugated metal pipe tile outlet including rodent guard as shown on the drawings.
 - (2) The corrugated metal pipe shall be 16 gage zinc-coated or aluminum coated with annular or helical corrugations.
 - (3) The corrugated metal pipe shall be connected to the corrugated polyethylene tubing by inserting 12 inches of corrugated polyethylene tubing into the corrugated metal pipe, and then fully sealing the entire opening with grout.
 - (4) Payment will constitute full compensation for the following related subsidiary item: Backfill of Required Excavation.
- c. Bid Item 14, Corrugated Metal Pipe, 18 In.
 - (1) This item consists of furnishing and installing the corrugated metal pipes including anti-seep collars, 18 In. diameter inlet pipe riser with 18 In. diameter stub, trash guard, and rodent guard for the water control structure as shown on the drawings.
 - (2) The corrugated metal pipe shall be close riveted caulked seam (CRCS) 16-gage zinc-coated steel round pipe with 2-2/3 in. x 1/2 in. annular corrugations. Helical corrugated pipe will not be allowed.
 - (3) Payment will constitute full compensation for the following related subsidiary items: Removal of Water; Structure Excavation; and Backfill of Required Excavation.
- d. Bid Item 15, Water Control Structure, 48 In.
 - (1) This item consists of furnishing and installing the water control structure complete with reinforced concrete base, 48 in. diameter riser with 18 in. diameter stubs as shown on the drawings and with an access ladder or manhole steps, adjustable stop logs, hook tool, and a lockable grated cover with lock and keys.

- (2) Submit detailed shop drawings of the water control structure and appurtenances for the Engineer's review and approval before fabrication of structure. Water control structure shall include the following:

- i. 48 in. diameter riser pipe with 18 in. diameter stubs. Riser pipe shall be 14 gage zinc-coated steel round CRCS pipe with 3 in. x 1 in. annular corrugations. Stub pipe shall be 16 gage zinc-coated steel round CRCS pipe with 2-2/3 in. x 1/2 in. annular corrugations.
- ii. Permanent access ladder or manhole steps attached on the dry side of riser and extending full length of riser structure.
- iii. Stop log track equal to riser height minus 1 foot. Each stop log track shall be furnished as one continuous piece and galvanized after fabrication. Tracks shall be securely fastened to the riser with 1/2 in. diameter galvanized bolts. Bituminous mastic shall be applied to provide a water tight connection between the stop log tracks and the riser.
- iv. Embed ladder, stop log tracks, and lowest stop log 3 inches into poured concrete base. Concrete shall have a minimum 28-day compressive strength of 3,500 psi.
- v. Stop logs shall have a tongue-and-groove interlocking configuration, 1 1/2 in. thick x 6 in. high (max) PVC. Three stop logs shall be 4 in. high. Provide minimum of 6 feet 9 inches of stop logs.
- vi. Stop logs shall have a minimum of 2 hooks for removal and replacement. Hooks not required for embedded stop log.
- vii. Hook tool, 9 feet in length, for stop log removal and replacement.
- viii. Attachment on dry side of riser for storage of hook tool.
- ix. Lockable grated cover for riser with padlock and four (4) keys.

- (3) Payment will constitute full compensation for the following related subsidiary items: Removal of Water; Structure Excavation; Backfill of Required Excavation; and Concrete.

e. Bid Item 16, Stop Log Storage Structure

- (1) This item consists of furnishing and installing the stop log storage structure complete with compacted rock base and a lockable grate with padlock.
- (2) Stop log storage structure shall include the following:
 - i. 24 in. diameter storage pipe. Storage pipe shall be 16 gage zinc-coated steel round CRCS pipe with 2-2/3 in. x 1/2 in. annular corrugations or high density polyethylene pipe complying with AASHTO M 294, Type S corrugated exterior and smooth interior.

- ii. 6 in. thick compacted rock base. Material shall meet the requirements of the Iowa Department of Transportation's Standard Specifications for Highway and Bridge Construction, Series 2015, for Granular Surfacing on Road, Class A Crushed Stone.
 - iii. Lockable grated cover for storage pipe with padlock identically keyed to padlock furnished for water control structure.
- (3) Payment will constitute full compensation for the following related subsidiary items: Structure Excavation; and Backfill of Required Excavation.

NATURAL RESOURCES CONSERVATION SERVICE CONSTRUCTION SPECIFICATION

IA-61 LOOSE ROCK RIPRAP

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments, structures and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap, filter layers or bedding shall come from sources approved by Engineer. The rock shall be excavated, selected and handled as necessary to meet the quality and grading requirements of this specification and the construction drawings.

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to sub rounded in shape. The least dimension of an individual rock fragment shall not be less than 1/3 the greatest dimension of the fragment unless otherwise specified on the construction drawings.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall be compacted to a density equal to the adjacent existing soil material.

Rock materials shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

4. EQUIPMENT-PLACED ROCK RIPRAP

Rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact, one to another, with the smaller rocks and spalls filling the voids between the larger rocks. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to adjacent structures.

5. HAND-PLACED RIPRAP

Rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact, one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute

for larger rock. Flat slab rock shall be laid on edge unless otherwise specified. Placement of rock shall begin at the bottom of the slope or downstream end of the structure.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established by the contract, the quantity of each type of rock riprap placed within the specified limits is computed to the nearest ton by actual weight. For each load of rock for riprap placed as specified, the contractor shall furnish to the owner a statement-of-delivery ticket showing the weight to the nearest 0.1 ton.

Payment is made at the contract unit price for each type of rock riprap. Such payment is considered full compensation for completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule, is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 8.

8. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 17, Riprap

- (1) This item shall consist of furnishing and placing the rock riprap in the locations shown on the drawings.
- (2) **Contractor shall use care in placement of riprap to ensure no material extends above the elevation of adjoining sheet pile.**
- (3) Quantity of excavation or embankment necessary to grade the surface on which the geotextile and riprap is to be placed is included in plan quantity for bid item 7, Channel Excavation or bid item 10, Earthfill.
- (4) Rock riprap shall conform to the requirements for Class E Revetment Stone as defined by the Iowa Department of Transportation, except that all riprap shall be screened by running the stone over a grizzly or plate screen with a minimum opening of 8 inches. This operation shall be done at the quarry. The portion of the stone that is removed by the screening operation will not be acceptable for use as riprap.
- (5) The Contractor will be responsible for removal of all remnants of riprap stockpiles utilized by the Contractor in the project area.

- (6) Payment will constitute full compensation for the following related subsidiary items:
Pollution Control; Removal of Water; and Structure Excavation.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-62 CONCRETE GROUT FOR RIPRAP

1. SCOPE

The work shall consist of furnishing, transporting, and placing concrete grout in the construction of grouted rock riprap sections as shown on the drawings.

2. MATERIALS

Cement shall be Type I or Type II Portland cement conforming to ASTM C 150. Fly ash conforming to Section 4108 of the IDOT Standard Specifications for Highway and Bridge Construction may be substituted for equivalent amount of Portland cement for amounts not to exceed 20 percent of the total amount of cementitious material in the grout. Aggregate shall meet Iowa Department of Transportation requirements for Fine Aggregate for Concrete, Section 4110 of IDOT Standard Specifications for Highway and Bridge Construction. Water shall be clean and free of harmful chemicals. Air entraining admixtures shall conform to ASTM C 260.

3. GROUT MIX

The grout mix shall be as follows:

- a) Cement: 10 sacks or 940 pounds per cubic yard
- b) Fine concrete aggregate: 2,100 pounds per cubic yard
- c) Water: 45 gallons per cubic yard or enough to provide a thick creamy consistency
- d) Air content: 6 to 10 percent.

When ready-mixed grout is furnished, the contractor shall furnish to the Engineer a delivery ticket showing the time of loading and the quantities of materials used for each load of grout mix.

No mixing water in excess of the amount called for in the grout mix shall be added during mixing, hauling or after arrival of the mix at the delivery point.

4. CONVEYING AND PLACING

Grout mix shall be delivered to the site and placed within 1 1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick setup of the grout mix, discharge of the concrete shall be accomplished in 45 minutes unless a set-retarding admixture is used, in which case the manufacturer's recommended time limit will apply.

Grout mix shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

The grout mix shall not be placed until the rock riprap has been inspected and approved.

Rock to be grouted shall be kept wet for at least 2 hours immediately prior to grouting. Grout shall not be placed in standing or flowing water.

The grout shall be consolidated by spading or mechanical vibration. The grout shall not be forced to flow laterally to its final location.

The average rate of grout application shall be 5.4 cubic feet per square yard of riprap (0.6 cubic feet per square foot).

5. CURING CONCRETE

Concrete shall be cured for 7 days by either:

- a) Applying white pigmented curing compound at a rate of 1 gallon per 150 square feet or as recommended by the manufacturer.
- b) Water soak exposed surface for the entire 7 days.
- c) Cover with burlap, mats or other material and maintain in a moist condition.
- d) Cover with 4 mil plastic sheeting while concrete is still wet.

Grout mix shall not be placed when daily minimum temperatures are expected to be lower than 40° F unless facilities are provided to maintain the temperature of the materials at 50° F to 90° F during placement and curing period. Grout may not be placed on frozen surfaces. When freezing conditions are expected, rock shall be heated to 50° F to 90° F for at least 24 hours prior to placing grout.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of grout placed within the specified limits is determined from the calculated batch volume and the number of mixed batches delivered to the site and placed in accordance with the specifications and drawings. Payment is made at the contract unit price for concrete grout. Such payment is considered full compensation for all labor, material, equipment, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in section 7 of this specification.

7. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 18, Concrete Grout

- (1) This item shall consist of furnishing and placing concrete grout on those portions of the riprap shown on the drawings.
- (2) **Contractor shall use care in placement of grout to ensure no material extends above elevation of adjoining sheet pile.**
- (3) Grout operation shall not be performed except in the presence of the Engineer.
- (4) The grout shall be consolidated into the voids with the use of a concrete vibrator. A smooth surface is not to be created by the grouting operation.

- (5) Grout unused or wasted, including any partial batch remaining at the completion of the operation, will be estimated and deducted by the Engineer from the volume for payment.
- (6) Payment will constitute full compensation for the following related subsidiary items: Pollution Control; and Removal of Water.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-81 METAL FABRICATION AND INSTALLATION

1. SCOPE

The work shall consist of furnishing, fabricating, and installing metalwork including metal parts of composite structures.

2. MATERIALS

Steel shall be of structural quality. Finished surfaces shall be smooth and true to assure proper fit.

Bolts, nuts, washers, rods, rivets, etc., shall be of a material equal to the steel being fastened.

3. PROTECTIVE COATINGS

Protective coatings will consist of either galvanizing or painting and shall be applied by the fabricator.

Galvanizing shall consist of a zinc coating by the hot dip process, except that bolts, nuts, and washers may have an electrodeposited zinc coating.

Paint System for this specification shall consist of the application of one coat of Epoxy Polyamide Primer (lead and chromate free) and one or more coats of Epoxy Polyamide (intermediate or finish), lead free. When finished, it will have a minimum dry film thickness of 8.0 mils.

4. FABRICATION

Materials shall be carefully fabricated as shown on the drawings. The fabrication shall be smooth and true to assure proper fit. Galvanized items shall not be cut, welded, or drilled after the zinc coating is applied.

5. ERECTION

The metal shall be erected true and plumb, closely conforming to the drawings.

6. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 19, Wale

- (1) This item shall consist of furnishing and installing the 10x15.3 C-channel wale as detailed on the drawings.
- (2) The contractor shall submit material certifications to the Engineer for approval.

- (3) Bolts, nuts, and washers required to install wale shall be included in and considered incidental to this item.
- (4) Protective coating of wale and hardware will not be required.
- (5) All bolt holes shall be field cut.
- (6) The length of wale installed will be measured to the nearest foot. For the length of wale installed, the Contractor will be paid the contract unit price per linear foot.

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATION**

IA-95 GEOTEXTILE

1. SCOPE

This work shall consist of furnishing all materials, equipment, and labor necessary for the installation of geotextile.

2. MATERIAL QUALITY

Geotextile shall be manufactured from synthetic long chain or continuous polymeric filaments or yarns, having a composition of at least 95 percent, by weight, of polypropylene, polyester or polyvinylidene-chloride. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other, are inert to commonly encountered chemicals and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. Unless otherwise specified, the class and type of geotextile shall be as shown on the drawings and shall meet the requirements for materials that follow:

- a. Woven Geotextile shall conform to the physical properties listed in Table 1. The woven geotextile shall be manufactured from monofilament yarns that are woven into a uniform pattern with distinct and measurable openings. The geotextile shall be manufactured so that the yarns will retain their relative position with regard to each other. The yarns shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure. The edges of the material shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.
- b. Nonwoven Geotextile shall conform to the physical properties listed in Table 2. Nonwoven geotextile shall be manufactured from randomly oriented fibers that have been mechanically bonded together by the needle-punched process. In addition, one side may be slightly heat bonded. Thermally bonded, nonwoven geotextiles, in addition to mechanically bonded, nonwoven geotextile, may be used for Road Stabilization. The filaments shall contain stabilizers and/or inhibitors to enhance their resistance to ultraviolet light or heat exposure.
- c. The geotextile shall be shipped in rolls wrapped with a protective covering to keep out mud, dirt, dust, debris and direct sunlight. Each roll of geotextile shall be clearly marked to identify the brand, type and production run.

3. STORAGE

Prior to use, the geotextile shall be stored in a clean dry place, out of direct sunlight, not subject to extremes of either hot or cold, and with the manufacturer's protective cover in place. Receiving, storage, and handling at the job site shall be in accordance with the requirements in ASTM D 4873.

4. SURFACE PREPARATION

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of loose

rock and clods, holes, depressions, projections, muddy conditions and standing or flowing water (unless otherwise on the drawings).

5. PLACEMENT

Prior to placement of the geotextile, the soil surface will be inspected for quality assurance of design and construction. The geotextile shall be placed on the approved prepared surface at the locations and in accordance with the details shown on the drawings. The geotextile shall be unrolled along the placement area and loosely laid (not stretched) in such a manner that it will conform to the surface irregularities when material is placed on or against it. The geotextile may be folded and overlapped to permit proper placement in the designated area.

The geotextile shall be joined by overlapping a minimum of 18 inches (unless otherwise specified), and secured against the underlying foundation material. Securing pins, approved and provided by the geotextile manufacturer, shall be placed along the edge of the panel or roll material to adequately hold it in place during installation. Pins shall be steel or fiberglass formed as a "U", "L", or "T" shape or containing "ears" to prevent total penetration. Steel washers shall be provided on all but the "U" shaped pins. The upstream or up-slope geotextile shall overlap the abutting down-slope geotextile. At vertical laps, securing pins shall be inserted through both layers along a line through approximately the midpoint of the overlap. At horizontal laps and across slope laps, securing pins shall be inserted through the bottom layer only. Securing pins shall be placed along a line approximately 2 inches in from edge of the placed geotextile at intervals not to exceed 12 feet unless otherwise specified. Additional pins shall be installed as necessary and where appropriate, to prevent any undue slippage or movement of the geotextile. The use of securing pins will be held to the minimum necessary. Pins are to be left in place unless otherwise specified.

Should the geotextile be torn or punctured, or the overlaps disturbed, as evidenced by visible geotextile damage, subgrade pumping, intrusion, or grade distortion, the backfill around the damaged or displaced area shall be removed and restored to the original approved condition. The repair shall consist of a patch of the same type of geotextile being used, overlaying the existing geotextile. The patch shall extend a minimum of 2 feet from the edge of any damaged area.

The geotextile shall not be placed until it can be anchored and protected with the specified covering within 48 hours or protected from exposure to ultraviolet light. In no case shall material be dropped on uncovered geotextile from a height greater than 3 feet.

6. SPECIAL SPECIFICATIONS

Items of work to be performed in conformance with this specification and the construction details therefor are:

a. Bid Item 20, Geotextile

- (1) This item shall consist of furnishing and placing geotextile on all earth surfaces that contact the rock riprap as shown on the drawings.
- (2) The material shall meet the requirements for Class II nonwoven geotextiles in accordance with Table 2. The contractor shall submit material data to the Engineer for approval.

- (3) The quantity of geotextile for which payment will be made, when placed as shown in the contract documents, will be the quantity shown in the contract documents in square yards. Material for laps is not included in the plan quantity.

TABLE 1. REQUIREMENTS FOR WOVEN GEOTEXTILES

Property	Test Method	Class I	Class II & III	Class IV
Tensile strength (pounds) ^{1/}	ASTM D 4632 grab test	200 minimum in any principal direction	120 minimum in any principal direction	180 minimum in any principal direction
Elongation at failure (percent) ^{1/}	ASTM D 4632 grab test	<50	<50	< 50
Puncture (pounds) ^{1/}	ASTM D 4833	90 minimum	60 minimum	60 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum
Apparent opening size – AOS	ASTM D 4751	As specified, but no smaller than 0.212 mm (#70) ^{2/}	As specified, but no smaller than 0.212 mm (#70) ^{2/}	As specified, but no smaller than 0.212 mm (#70) ^{2/}
Percent open area (percent)	CWO-02215-86	4.0 minimum	4.0 minimum	1.0 minimum
Permittivity sec ⁻¹	ASTM D 4491	0.10 minimum	0.10 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size

Note: CWO is a USACE reference.

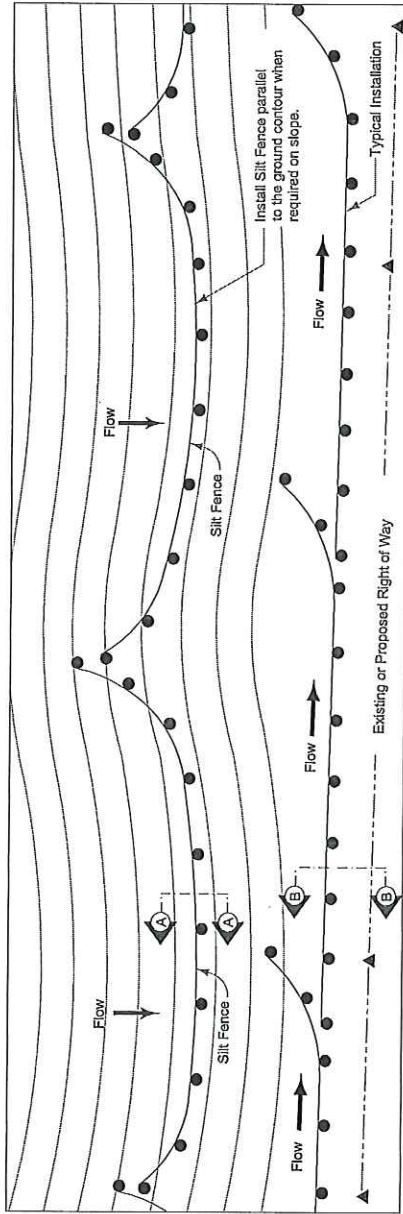
TABLE 2. REQUIREMENTS FOR NONWOVEN GEOTEXTILES

Property	Test Method	Class I	Class II	Class III	Class IV ^{3/}
Tensile strength (pounds) ^{1/}	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) ^{1/}	ASTM D 4632	≥50	≥50	≥ 50	>50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size – AOS	ASTM D 4751	As specified max. # 40 ^{2/}	As specified max. # 40 ^{2/}	As specified max. # 40 ^{2/}	As specified max. # 40 ^{2/}
Permittivity sec ⁻¹	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U.S. standard sieve size

3/ Heat-bonded or resin bonded geotextile may be used for classes III and IV. They are particularly well suited to class IV. Needle punched geotextiles are required for all other classes.




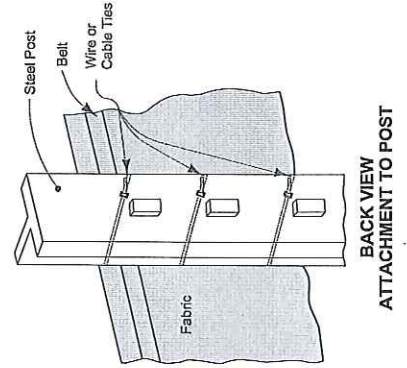
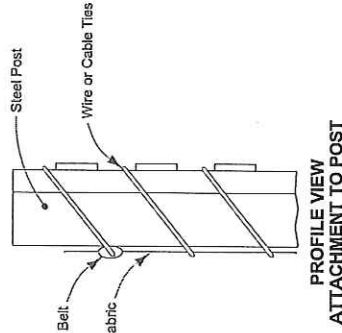
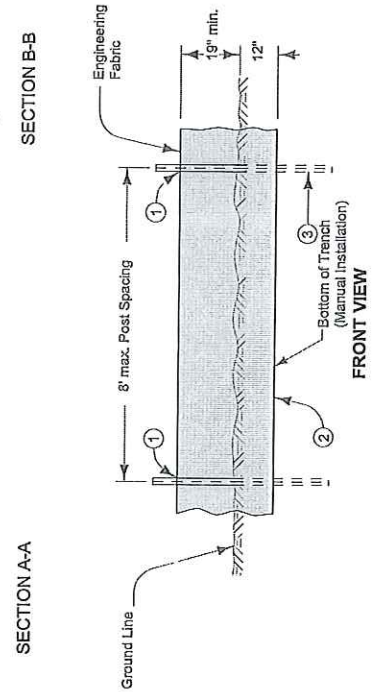
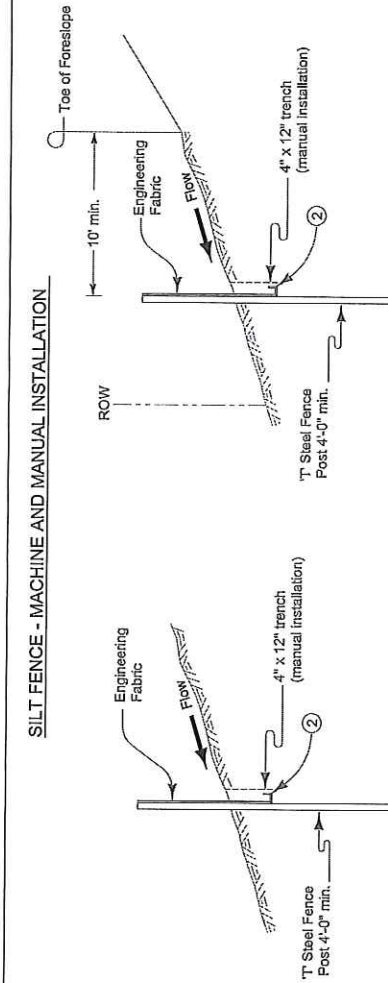
Install all silt fence using a silt fence machine. Use manual (trench) installation if physical conditions prohibit machine installation.

For machine installation, compact by driving over each side of silt fence at least two times with device exerting 60 p.s.i. or greater.

For manual installation, compact with a mechanical or pneumatic tamper.

Place silt fence continuously up to a maximum length of 200 feet. For every segment of silt fence that is placed, flare up the slope the last 20 feet of the segment to contain runoff as shown.

- ① Secure top of engineering fabric to steel posts using cable ties (50 lb.) or wire. See back view attachment to post.
- ② For manual installation only, fold engineering fabric along bottom of trench.
- ③ Embed all posts 28 inches below the ground line.



Contour Lines